Chapter 2
Decision-Making Systems, Models, and Support



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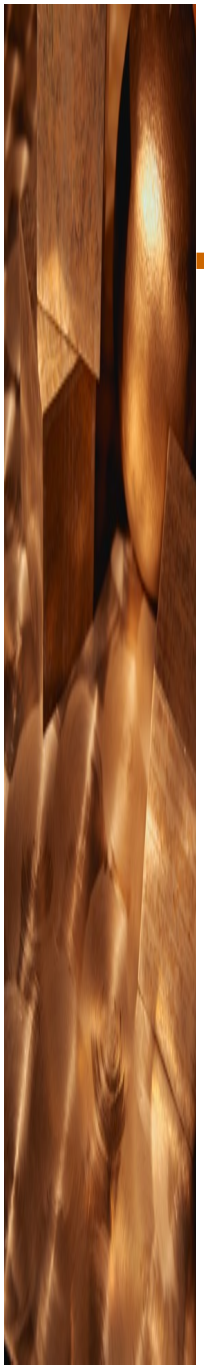
Team-Based Decision-Making



- In general, about 10 percent of workers cannot function in a team environment. Why?
- This is sometimes because of personality issues, or because they are top performers or
- bottom performers who refuse to cooperate with a team. These people must be let go when building a team culture.

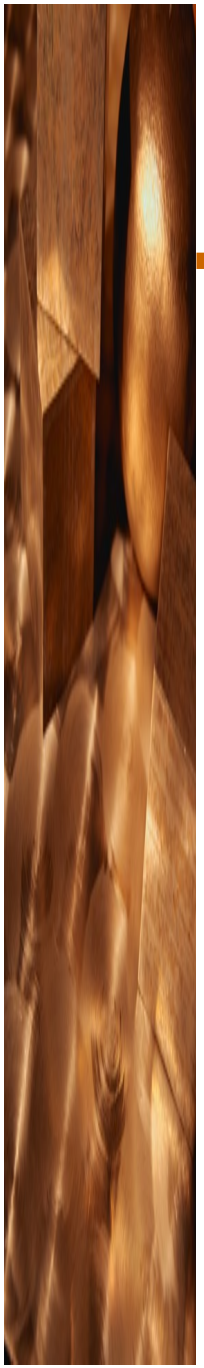
Team-Based Decision-Making

- Team-based decision making
 - Increased information sharing
 - Daily feedback
 - Self-empowerment
- Shifting responsibility towards teams
- Elimination of middle management
- Most managerial decision making has moved to the self-directed teams. The workers need little supervision. Overall, empowered workers, when rewarded appropriately, make good decisions .

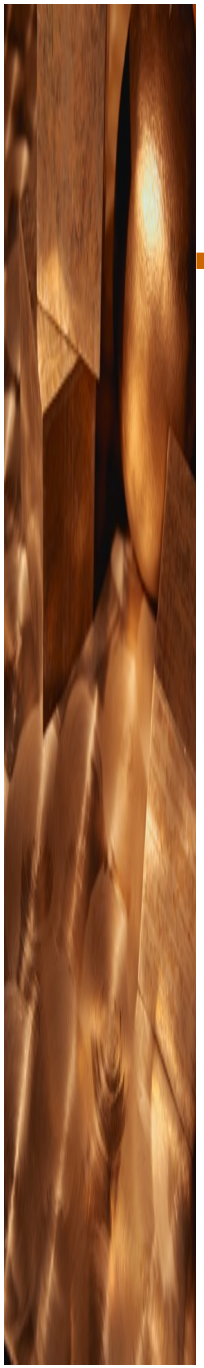


Problems with Group –decision making

- Group members may have biases.
- There can be several, conflicting objectives.
- Many decisions involve risk. Different people have different attitudes toward risk.

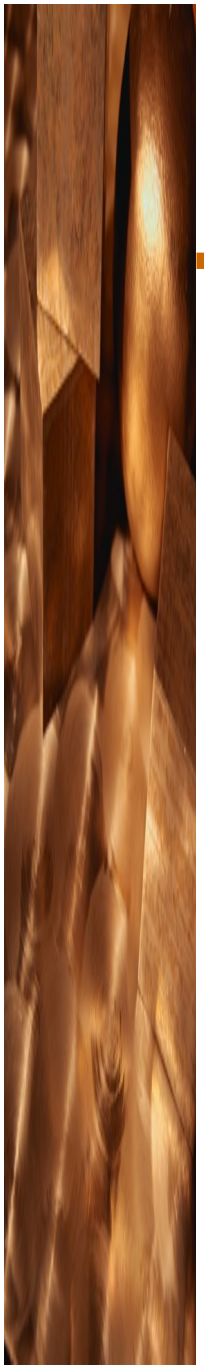


- Why are self-directed team members happier than workers under a traditional hierarchy?
- There has been less friction between management and union representatives.
- The Workers are responsible for scheduling shipments, determining overtime, scheduling shifts, work assignments, and so on. Team members are responsible for making decisions when production falls off.
- Little stress.



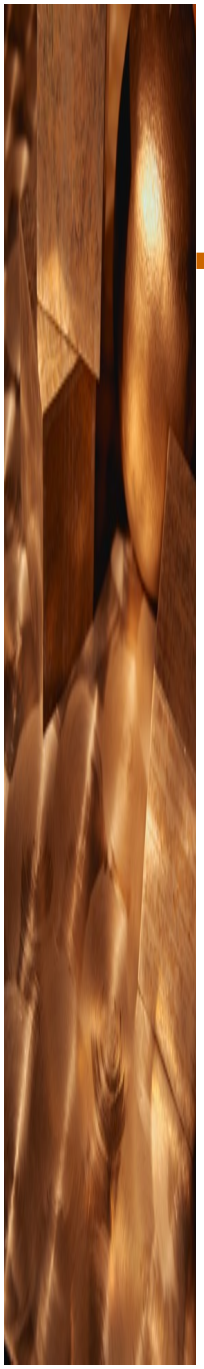
Decision Making

- Process of choosing among alternative courses of action for the purpose of attaining a goal or goals.
- The Simon's four phases of the decision process are:
 - Intelligence
 - Design
 - Choice
 - implementation



Decision-making and Problem solving

- Some consider the entire process (phases 1-4) as problem solving, with the choice phase as the real decision-making.
- Others view phases 1-3 as formal decision-making ending with a recommendation, whereas problem-solving additionally includes the actual implementation of the recommendation (phase 4).
- Through this course, the terms decision-making and problem-solving are used interchangeably.



Systems

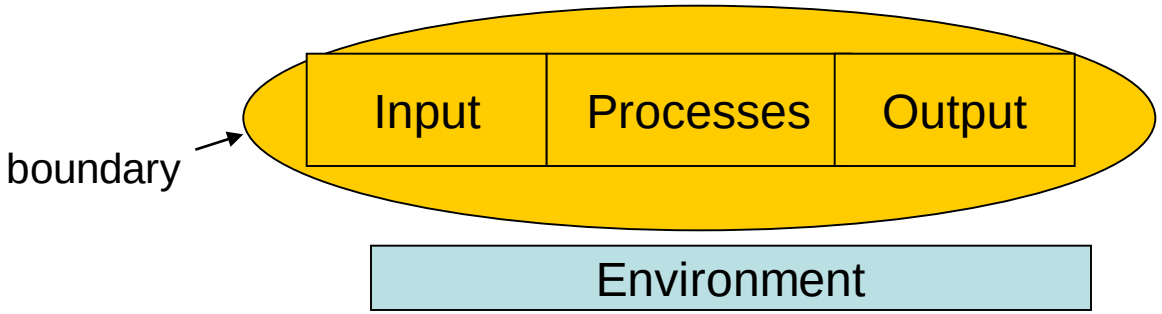
- **A *SYSTEM* is a collection of objects such as people, resources, concepts, and procedures intended to perform an identifiable function or to serve a goal**

- **System Levels (Hierarchy): All systems are *subsystems* interconnected through *interfaces***

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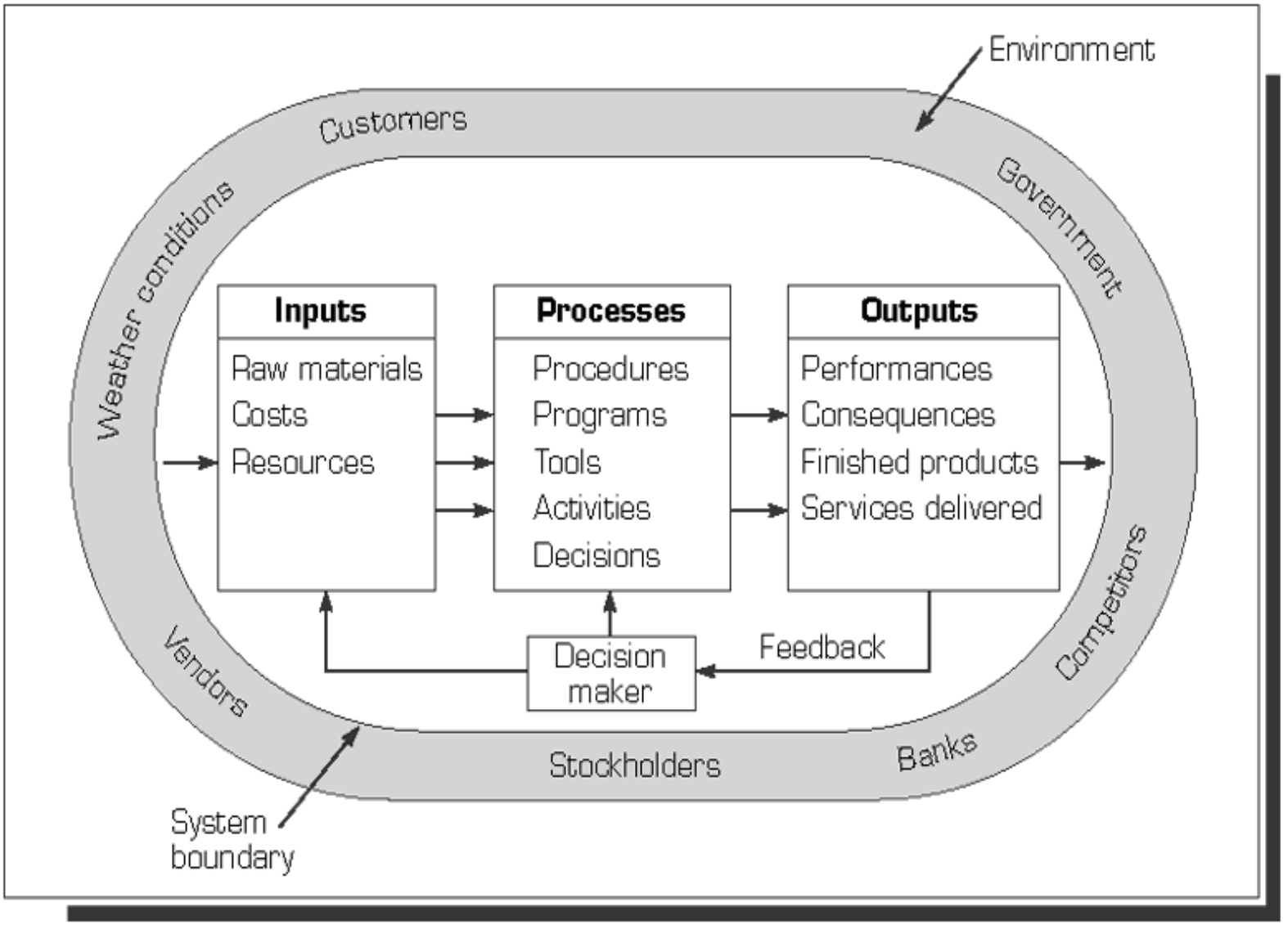
Systems

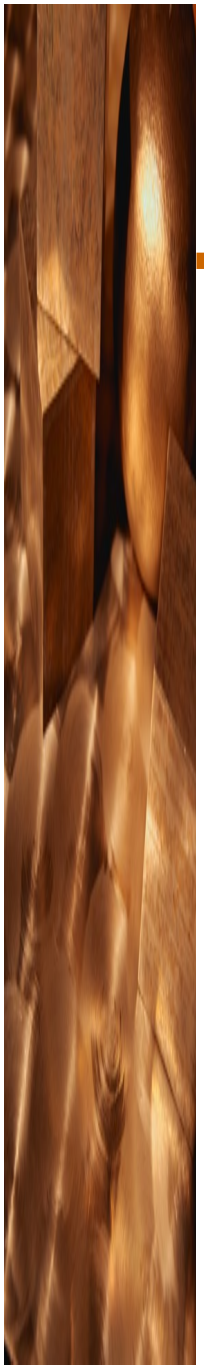
- Structure
 - Inputs
 - Processes
 - Outputs
 - Feedback from output to decision maker
- Separated from environment by boundary
- Surrounded by environment



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Figure 2.1 The System and Its Environment





How to Identify the Environment?

Answer Two Questions

1. **Does the element matter relative to the system's goals? [YES]**
2. **Is it possible for the decision maker to significantly manipulate this element? [NO]**

Environmental Elements Can Be

- **Social**
- **Political**
- **Legal**
- **Physical**
- **Economical**
- **Often Other Systems**

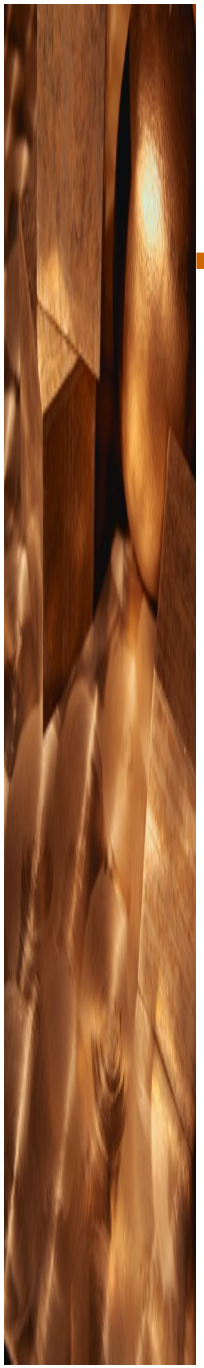
System Types

- Closed system
 - Independent of other systems and subsystems
 - Takes no inputs
 - Delivers no outputs to the environment
 - Black Box(is one in which inputs and outputs are well defined, but the process itself is not specified.)
- Open system
 - Accepts inputs
 - Delivers outputs to environment

Decision-support systems attempt to deal with systems that are fairly open.

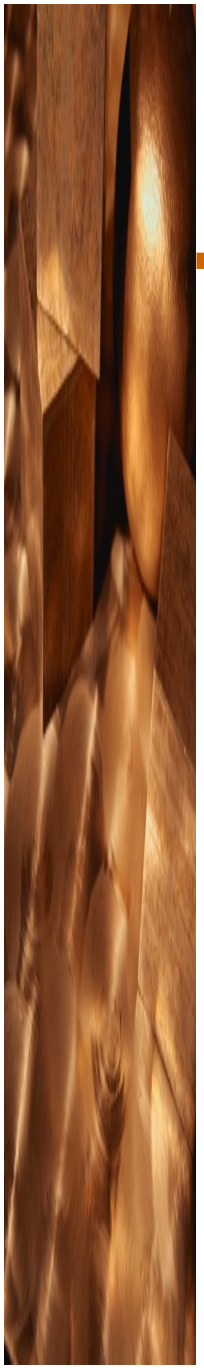
Closed & Open system

- For example, the a *research-and-development* (R&D)department of a company may have much less interaction with people outside the department as compared to marketing department. Therefore, we may consider the R&D department organization as a closed system, and *Marketing department* as an open system.



Closed & Open system

- Some people can see a *production line* as an example of a closed system within an organization. The daily work that takes place on production or assembly lines can be insulated from outside factors such as day-to-day meetings between upper-level executives, or information from other similar, competing production lines.



An Information System

- Collects, processes, stores, analyzes, and disseminates information for a specific purpose
- Is often at the heart of many organizations
- Accepts inputs and processes data to provide information to decision makers and helps decision makers communicate their results

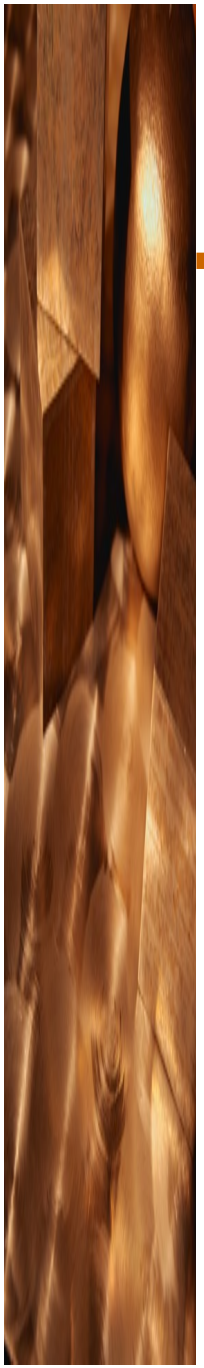
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System types in an organization

- **Transaction Processing Systems** (TPS): are the basic business systems that serve the operational level of the organization. And it is also a computerized system that performs and records the daily routine transactions necessary to conduct business.
- **Management Information Systems** (MIS): serve the management level of the organization, providing managers with reports and often-online access to the organization's current performance and historical records and primarily serve the functions of planning, controlling, and decision-making.

System types in an organization

- **Decision-Support System** (DSS): also serve the management level or the organization. DSS help mangers make decisions that are unique, rapidly changing, and not easily specified in advance.
- **Executive Support System** (ESS): serve the strategic level of the organization. They address nonroutine decisions requiring judgment, evaluation, and insight because there is no agreed on procedure for arriving at a solution.

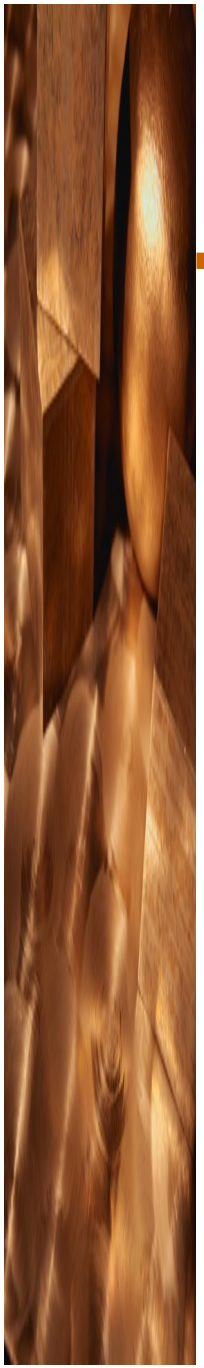


Performance Measurement
Effectiveness and Efficiency

- *Effectiveness* is the degree to which goals are achieved
 Doing the right thing!
 تعبر عن مقدار ما تم تحقيقه من الاهداف
- Efficiency is a measure of the use of inputs (or resources) to achieve outputs
 Doing the thing right!
- تعبر عن كيفية استغلال الموارد المتاحة لتحقيق الاهداف المطلوبة
- Productivity =(*efficiency/effectiveness)=outputs/inputs*
- Measurable?

 several non-quantifiable.

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Models

- **Major Component of DSS**
- **Use Models instead of experimenting on the real system**

- **A *model* is a simplified representation or abstraction of reality.**
- **Reality is generally too complex to copy exactly**
- **Much of the complexity is actually *irrelevant* in problem solving**

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Degrees of Model Abstraction

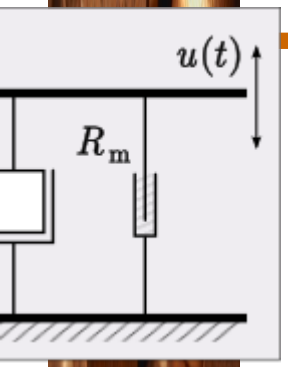
- **Verbal Models.**

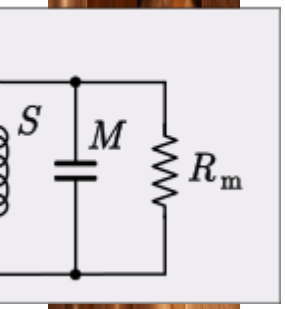
Verbal models use words to represent some object or situation that exists, or could exist, in reality. Verbal models may range from a simple word presentation of scenery described in a book to a complex business decision problem (described in words and numbers).

- ***Iconic (Scale or physical) Models*: Physical** replica (relative shape, form, and weight) of a system(three dimensional models) they represent

Cumbersome and time consuming



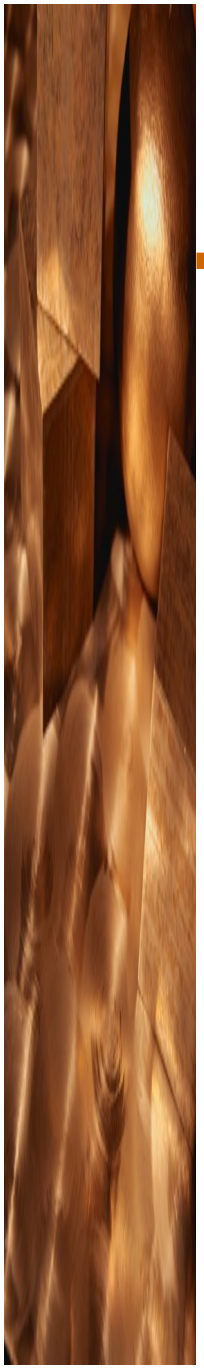




- *Analog(schematic) Model* behaves like the real system *but* does *not* look like it (symbolic representation)(two-dimensional charts or diagrams).They can be physical models, but the shape of the model differs from that of the actual system
- *Mathematical (Quantitative) Models* use mathematical relationships to represent complexity.(V=IR)

*Mathematical (Quantitative) Models u*sed in most DSS analyses.

- Advances in computer graphics, especially through Web interfaces and their associated object-oriented programming languages, have led to an increased tendency to use iconic and analog models to complement MSS mathematical modeling.
- For example, visual simulation combines all three types of models.



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TABLE 2.2 Simon's Four Phases of Decision-Making and the Web

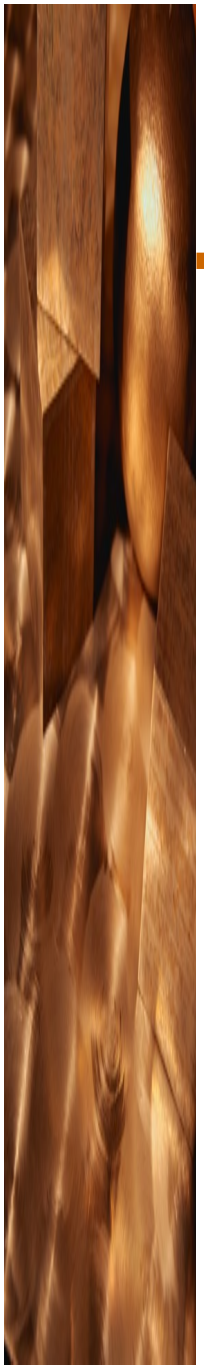
Phase	*Web Impacts*	*Impacts On The Web*
1. Intelligence	Access to information to identify problems and opportunities from internal and external data sources Access to AI methods and other data-mining methods to identify opportunities Collaboration through GSS and KMS Distance learning can provide knowledge to add structure to problems	Identification of opportunities for e-commerce, Web infrastructure, hardware and software tools, etc. Intelligent agents lessen the burden of information overload Smart search engines
2. Design	Access to data, models, and solution methods Use of OLAP, data mining, data warehouses Collaboration through GSS and KMS Similar solutions available from KMS	Brainstorming methods (GSS) to collaborate in Web infrastructure design Models and solutions of Web infrastructure issues
3. Choice	Access to methods to evaluate the impacts of proposed solutions	DSS tools examine and establish criteria from models to determine Web, intranet, and extranet infrastructure DSS tools determine how to route messages
4. Implementation	Web-based collaboration tools (GSS) and KMS can assist in implementing decisions. Tools monitor the performance of e-commerce and other sites, intranet, extranet, and the Internet itself	Decisions were implemented on browser and server design and access: these ultimately determined how to set up the various components that have evolved into the Internet

Phases of Decision-Making

- Simon's Decision-making phases:
 - Intelligence
 - Design
 - Choice
 - Implementation

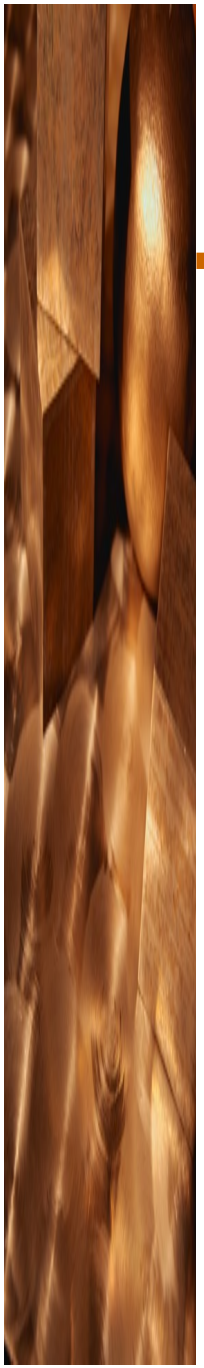
Decision-Making Intelligence Phase

- Scan the environment
- Analyze organizational goals
- Collect data
- Identify problem
- Categorize problem
 - Programmed and non-programmed
 - Decomposed into smaller parts
- Assess ownership and responsibility for problem solution



Decision-Making Design Phase

- The design phase involves finding or developing and analyzing possible courses of action.
- Create model
- Test for feasibility
- Validate results
- Select a principle of choice
 - Establish objectives
 - Incorporate into models
 - Risk assessment and acceptance
 - Criteria and constraints



Modeling is Art and Science

- The process of modeling is a combination of art and science. As a science, there are many standard model classes available, and with practice an analyst can determine which one is applicable to a given situation(problem).

- As an art, a level of creativity and finesse is required when determining what simplifying assumptions can work, how to combine appropriate features of the model‘s classes, and how to integrate models to obtain valid solutions

Decision-Making Design Phase

- Principle of choice
 - Describes acceptability of a solution approach.

 Are we willing to assume high risk, or do we prefer a low-risk approach?

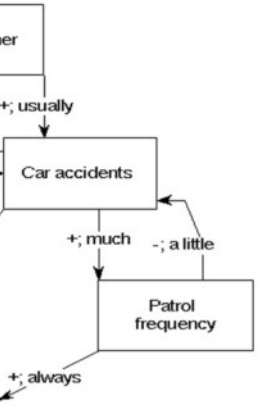
 Are we attempting to optimize or satisfice?
 - Among the many principles of choice, normative and descriptive models are of prime importance.

Decision-Making Design Phase

- Normative Models
 - Normative models are those in which the chosen alternative is demonstrably the best of all possible alternatives. To find it, one should examine all the alternatives and prove that the one selected is indeed the best, which is what one would normally want. This process is basically optimization.
 - Suboptimization
 - Decisions made in separate parts of organization without consideration of whole.

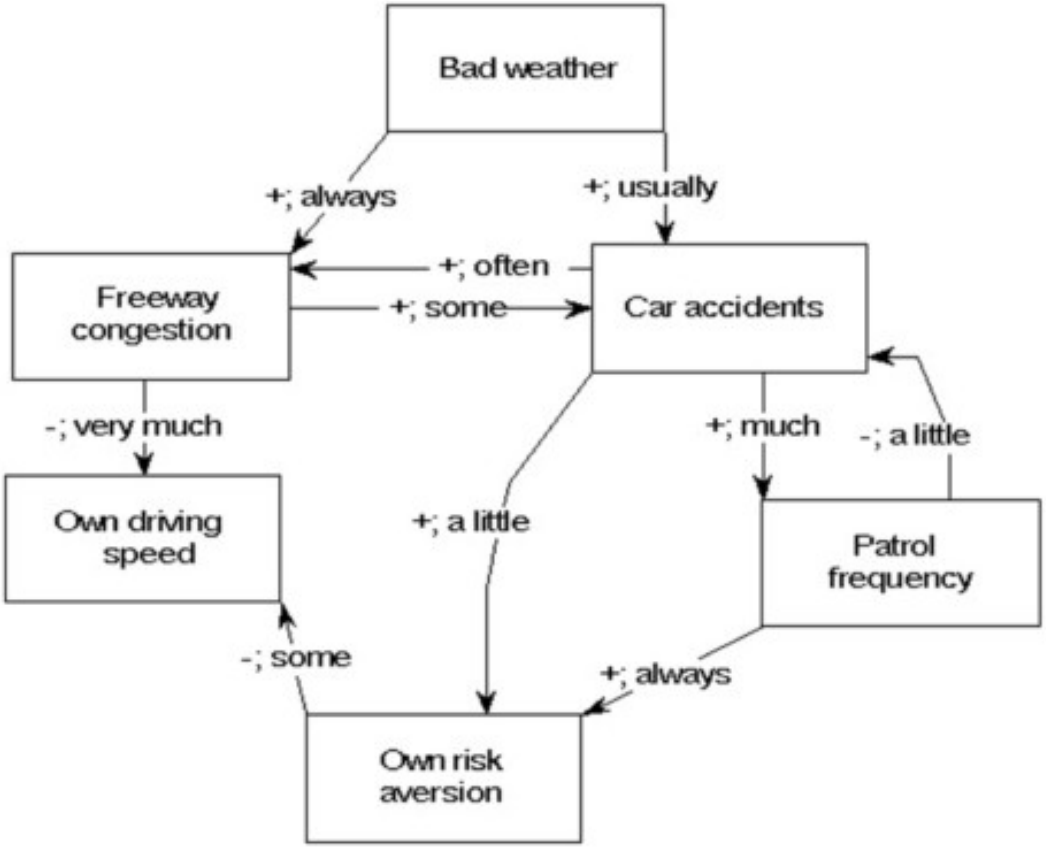
Descriptive Models

- Describe how things are believed to be
- Typically, mathematically based
- Can't guarantee optimal solution.
- Simulation is probably the most common descriptive modeling method.
- Nonmathematical descriptive models:
 - Cognitive map(Decision Explorer software)
 - Narratives (A narrative is a story that, when told, helps a decision maker uncover the important aspects of the situation and leads to better understanding and framing. It is extremely effective when a group is making a decision)



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Descriptive Models

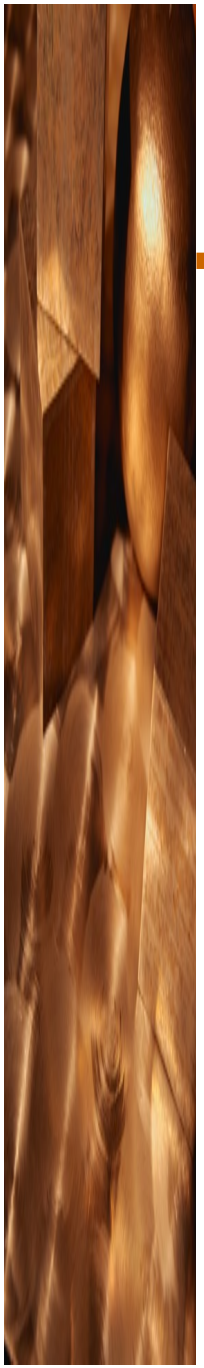


Developing Alternatives

- Generation of alternatives
 - May be automatic by the model or manual by the decision-maker
 - May lead to information overload
 - Scenarios
 - Outcome measured by goal attainment.
 - When to stop ????? Is challenge point

SCENARIOS

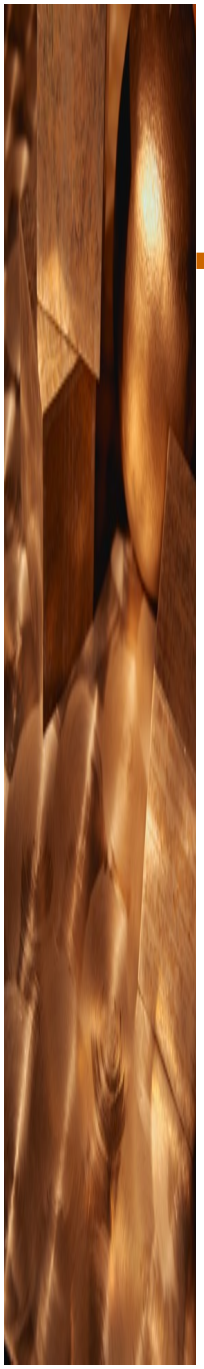
- A scenario is a statement of assumptions about the operating environment of a particular system at a given time.
- A scenario describes the decision and uncontrollable variables and parameters for a specific modeling situation.
- It also may provide the procedures and constraints for the modeling.
- A scenario is especially helpful in simulations and what-if analysis. In both cases, a manager changes scenarios and examine the results.



POSSIBLE SCENARIOS

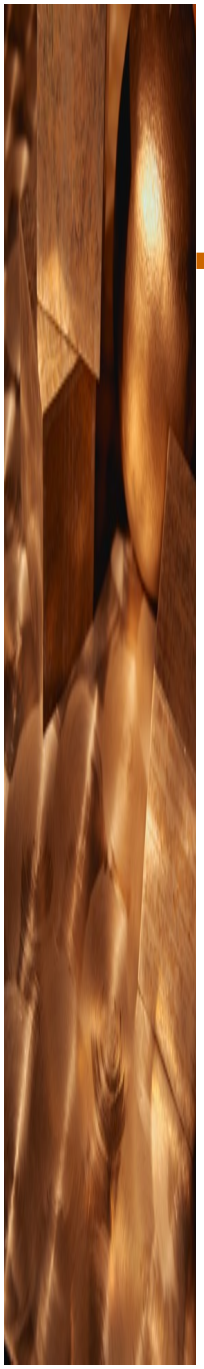
- There may be thousands of possible scenarios for every decision situation. However, the following are especially useful in practice:
 - **Worst possible**
 - **Best possible**
 - **Most likely (Typical or average values)**

The scenario determines the context of the analysis to be performed.



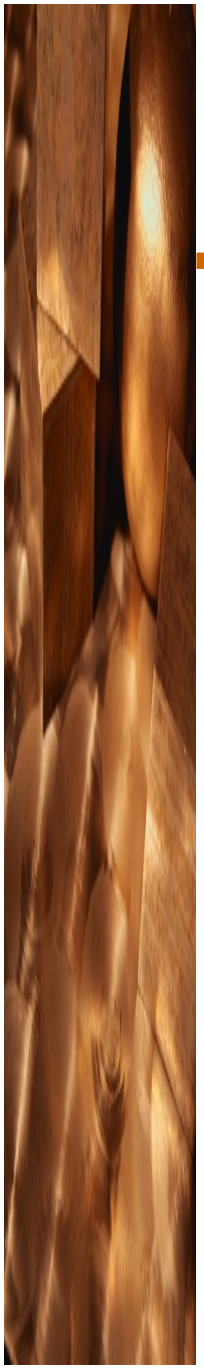
Decision-Making Choice Phase

- The choice phase is the one in which the actual decision is made and where the commitment to follow a certain course of action is made.
- The boundary between the design and choice phases is often unclear because certain activities can be performed during both of them and because one can return frequently from choice activities to design activities.
- For example, one can generate new alternatives while performing an evaluation of existing ones.



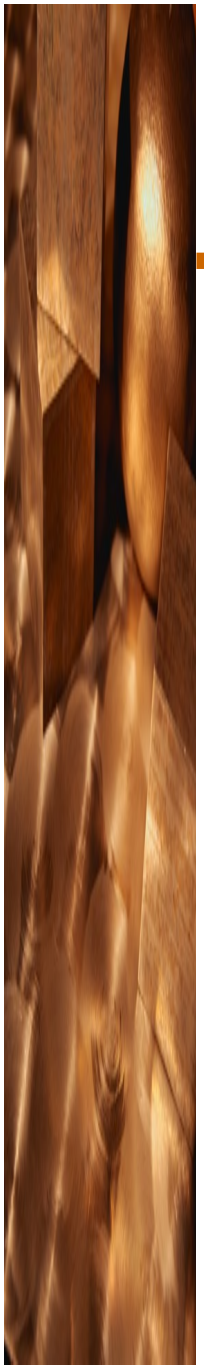
Decision-Making Choice Phase

- The choice phase includes the search, evaluation, and recommendation of an appropriate solution to the model.
- A solution to a model is a specific set of values for the decision variables in a selected alternative.
- Solving a decision-making model involves searching for an appropriate course of action.
- **These search approaches** include analytical techniques (solving a formula), algorithms (step-by-step procedures), heuristics(use experiments, trial and error methods), and blind search (shooting in the dark with no information about environment, ideally in a logical way).



Note

- Solving the model is not the same as solving the problem the model represents.
- The solution to the model yields a recommended solution to the problem.
- The problem is considered solved only if the recommended solution is successfully implemented.

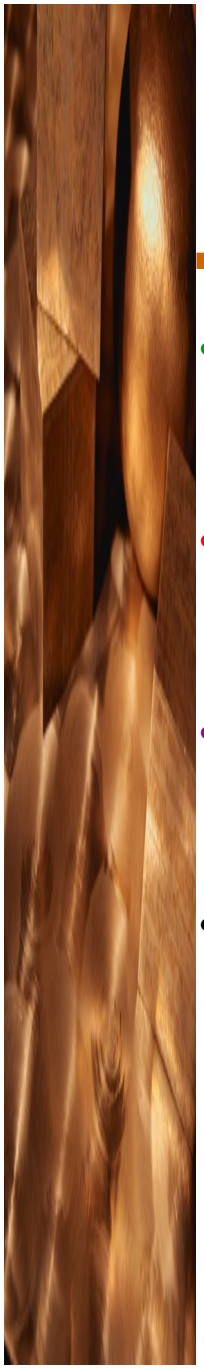


Decision-Making Implementation Phase

- Putting a recommended solution to work

Implementation issues(Vague boundaries-elements play great role in implementation phase**):**

 - **Resistance to change.**
 - **Degree of top management support.**
 - **Users' roles and involvement in system development.**
 - **Users' training.**



Summary

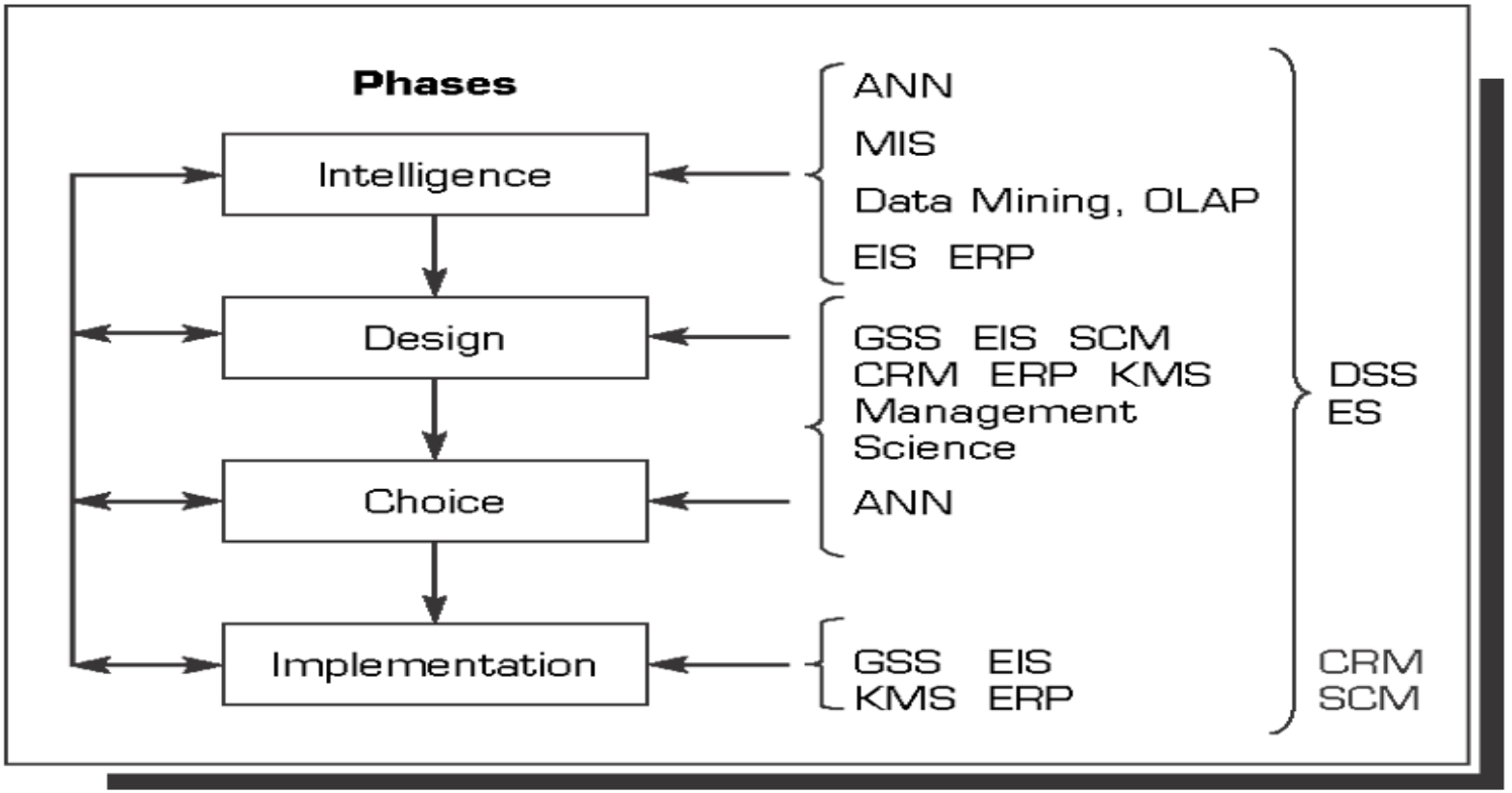
- **Intelligence phase**
 - Reality is examined
 - The problem is identified and defined
- **Design phase**
 - Representative model is constructed
 - The model is developed and evaluation criteria are set
- **Choice phase**
 - Includes a recommended solution to the *model*
 - If reasonable, move on to the
- **Implementation phase**
 - Putting a recommended solution to work
 - Solution to the original problem

 Failure: Return to the modeling process

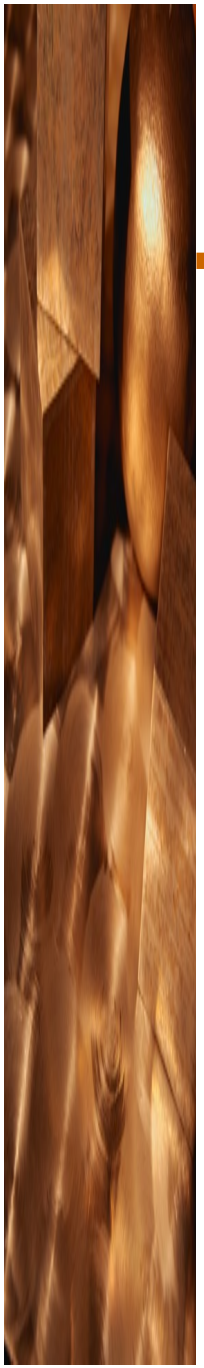
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Relation between Management support system technologies and the decision-making process

Figure 2.3 DSS Support



Source: Based on Sprague, R.H., Jr., "A Framework for the Development of DSS." MIS Quarterly, Dec. 1980, Fig. 5, p. 13.



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